

## Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor		Equipment				Materials		Total	
Per. HrsRateCostTypeDaysrateCostItemCostCost															
BIOFILTER – STRIPS and SWALES - a															
Based on 2 ha drainage area.															
Uniform sheet flow over length of strip and across swale invert	Evidence of significant channeling, erosion, seeps, or ponding	Visual inspection of strip/swale	Annually.	Correct channelized, eroded, seeped, or ponded areas using additional fill and vegetation depending on coverage and/or by removing accumulated sediment. Complete prior to wet season.	None	4	44.00	176	one-ton truck & hydroseeder	0.25	48.15	12	seed	100	288
Height of vegetation -b	Average vegetation height exceeds 12 inches, emergence of trees, or woody vegetation	Visual inspection of vegetation throughout strip/swale	Once during wet season, once during dry season. (depending on growth)	Cut vegetation to an average height of 6 inches	Remove any trees, or woody vegetation.	32	44.00	1408	one-ton truck	2.	26.84	54	string trimmer, rake, fork, bags, safety equipment	50	1512
Assess adequate vegetative cover -d	Less than 90 percent coverage in strip invert/swale or less than 70 percent on swale side slope	Visual inspection of strip/swale. Prepare a site schematic to record location and distribution of barren or browning spots to be restored. File the schematic for assessment of persistent problems.	Assess quantity needed in May each year late wet season and late dry season.	Reseed/revegetate barren spots by Nov.		2	44.00	88	one-ton truck & hydroseeder	0.25	48.15	12	seed	100	200
				Contact environmental or landscape architect for appropriate seed mix.	Ensure reseed material is available for September.	0	44.00	0		0		0		0	
				Scarify area to be restored, to a depth of 2-inches. Restore side slope coverage with hydroseed mixture.		1	44.00	22	one-ton truck & hydroseeder	0.25	48.15	12		34	
				If after 2 applications (2 seasons) of reseeding/revegetating and growth is unsuccessful both times, an erosion blanket or equivalent protection will be installed over eroding areas		2	44.00	88	one-ton truck & hydroseeder	0.25	48.15	12	blanket	60	160
Inspect for debris accumulation	Debris or litter present	Visual observation	During routine trashing, per Districts schedule.	Remove litter, and debris.	None	0	44.00	0				0			0
Inspect for accumulated sediment - c	Sediment at or near vegetation height, channeling of flow, inhibited flow due to change in slope.	Visual observation	Annually	Remove sediment. If flow is channeled, determine cause and take corrective action. If sediment becomes deep enough to change the flow gradient, remove sediment during dry season, characterize and properly dispose of sediment, and revegetate.		4.8	44.00	211	one-ton truck & hydroseeder	0.2	48.15	10			221
				Notify engineer to determine if regrading is necessary. If necessary, regrade to design specification and revegetate swale/strip. If regrading is necessary, the process should start in May. Revegetate strip/swale in Nov. Target completion prior to wet season.	None	2	44.00	88	4-yd dump truck, backhoe & trailer, one-ton truck & hydroseeder sedan	0.33	176.50	58		146	
Inspect for burrows	Burrows, holes, mounds	Visual observation	Annually and after vegetation trimming.	Where burrows cause seepage, erosion and leakage, backfill firmly.		1	44.00	44	one-ton truck & hydroseeder	0.25	48.15	12			56
General Maintenance Inspection -e	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, emergence of trees, woody vegetation , fence damage, etc.	Visual observation	Semi-Annually, late wet season and late dry season.	Corrective action prior to wet season. Consult engineer if an immediate solution is not evident.	Remove any trees, or woody vegetation.	0	44.00	0				0			0
						3	44.00	132		0		132			
Reporting						51		2244			182		310	2736	
TOTAL BIO FILTER AND SWALES															

- a. Maintenance hours includes inspection time, which will occur whether or not maintenance will be required.
- b. assumes cut twice per year, in 8 hours by two man crew. Only area within swale Includes travel.
- c. assumes cleanout once every 5 years, 3 man crew, 8 hours per worker.
- d. Assumes inspection of multiple BMPs and inspection is accomplished under uniform sheet flow.
- e. Maintenance included in the vegetation trimming and in sediment removal.

### Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor			Equipment				Materials		Total
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost
CONTINUOUS DEFLECTIVE SEPARATION (CDS) UNITS															
Based on 2 ha drainage area.															
Inspect sump for accumulation of material.	Unit 85 percent full-c or	Visual observation using a depth measuring gauge	Monthly during the wet season			9	44.00	396	one-ton truck	9.	26.84	242			638
	When the sump is 50% full during two consecutive monthly inspections. or					0									
	Annually in May, effect cleaning within 15 days-d			Empty unit		32	44.00	1408	one-ton truck & vactor	4.	198.75	795			2203
Inspect weir box for accumulation of material. -b	Presence of trash and debris	Visual observation	Monthly during the wet season	Remove trash and debris while onsite conducting inspection.-a		0									
Inspect for standing water.-b	Standing water in sump	Visual observation	Annually, 72 hours after target2 storm (0.75 in)	If standing water cannot be removed or remains through the wet season notify VCD.	None	0	44.00	0							
Inspect the screen for damage and to ensure that it is properly fastened.-b	Screen becomes clogged, damaged or loose	Visual observation	Annually before wet season.	Clean screen. -a	None	0									
Inspection for structural integrity-b	Holes in screen, large debris, damage to housing or weir box	Visual observation	Annually or after a cleanout.	Immediately consult with engineer and manufacturer's representative to develop a course of action, effect repairs prior to the wet season. -a	None	0									
Reporting						3	44.00	132							132
TOTAL CDS UNITS						44		1936		13.		1037		0	2973

- a. Hours included in inspection of accumulation of material.  
b. to occur during inspections for sump material accumulation  
c. Assumes one man, one hours, nine inspections per year  
d. Assumes 2-man crew, 4 hours per cleanout, 4 cleanouts per year.

## Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor			Equipment				Materials		Total
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost
DRAIN INLET INSERTS – FOSSIL FILTER™ -a															
Inspect for debris/trash Before and once during each target storm (0.25 in) event - b	Sufficient debris/trash that could interfere with proper functioning of insert	Visual observation	During the wet season:	Remove and properly dispose of debris/trash. Target completion period while onsite conducting inspection.		13	44.00	572				0			572
Oil and grease removal	Absorbent granules dark gray, or darker, or unit clogged with sediment.					Visual observation	At the end of each target storm (0.25 in) event	Replace Fossil Filter™ adsorbent within 10 working days. Characterize and properly dispose spent media prior to wet season.	2	44.00	88				0
Inspection for structural integrity	Broken or otherwise damaged insert	Visual observation	Twice per year in October and May.	Replace insert or immediately consult vendor to develop course of action, effect repairs within 10 working days	None	2	44.00	88				0			88
Annual renewal of medium Reporting	End of wet season, April 30	None	Annually, in May	Remove, characterize, and properly dispose of media a Replace media before Oct 1	None	2	44.00	88	sedan	1.	21.28	21	new adsorbent and testing & disposal costs	115	224
						3	44.00	132							
TOTAL DRAIN INLET INSERTS-FOSSIL FILTERS						22		968				21		115	1104

a. Maintenance hours includes inspection time, which will occur whether or not maintenance will be required.

b. average of 13 storms per year,2-man, half hour per site

<b>DRAIN INLET INSERTS – STREAM GUARD™ -a</b>															
Sediment removal -c	Sediment more than 6-inches	Visual inspection of sediment collected within insert Before each target storm (0.25 in) event	During the wet season:	Replace insert. Target completion while onsite conducting inspection.		0	44.00	0				0			0
Inspect for debris/trash -b	Sufficient debris/trash that could interfere with proper functioning of insert	Visual observation Before and once during each target storm (0.25 in) event	During the wet season	Remove and dispose of debris/trash. Target completion period while onsite conducting inspection.		13	44.00	572				0			572
Oil and grease removal	When oil absorbent polymer becomes saturated with oil	Visual observation (absorbent polymer expansion indicates oil saturation)	At the end of each target storm (0.25 in) event	Within 10 working days, replace oil absorbent polymer		2	44.00	88				0			88
Inspection for structural integrity	Signs of rips, gashes, and/or fallen media	Visual observation	Twice per year in October and May.	Replace insert or immediately consult vendor to develop a course of action, effect repairs within 10 working days	None	2	44.00	88				0			88
Annual renewal of medium Reporting	End of wet season, April 30	None	Annually, in May	Remove characterize, and properly dispose of media.. Replace media before Oct 1	None	2	44.00	88	sedan	1.	21.28	21	new adsorbent and testing & disposal costs	115	224
<b>TOTAL DRAIN INLET INSERTS-STREAM GUARDS</b>						22		968				21		115	1104

a. Maintenance hours includes inspection time, which will occur whether or not maintenance will be required.

b. average of 13 storms per year,2-man, half hour per site

c. Cost included in inspections for debris and trash

## Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor		Equipment				Materials		Total	
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost
EXTENDED DETENTION BASINS -a															
Based on 2 ha drainage area.															
Basin side slope planted for erosion protection and planted invert -e	Average vegetation height greater than 12-inches, emergence of trees or woody vegetation,	Visual observation and random measurements through out the side slope area	Once during wet season, once during dry season.	Cut vegetation to an average height of 6-inches and remove trimmings. Remove any trees, or woody vegetation.		32	44.00	1408	one-ton truck	2.	26.84	54	string trimmer, rake, fork, bags, safety equipment	50	1512
Slope stability -c	Evidence of erosion	Visual observation	October each year	Reseed/revegetate barren spots prior to wet season.		0	44.00	0				0			0
				Contact environmental or landscape architect for appropriate seed mix.		0	44.00	0				0			0
				Scarify surface if needed.		0	44.00	0				0			0
				If after two applications (2 seasons) of reseeding/revegetating and growth is unsuccessful both times, an erosion blanket or equivalent protection will be installed over eroding areas. No erosion blanket will be installed in the basin invert.		0	44.00	0				0			0
Inspect for standing water. -d	Standing water for more than 72 hours	Visual observation	Annually, 72 hours after a target storm (0.75 in) event	Drain facility	None	4	44.00	176	one-ton truck	0.25	26.84	7			183
				Check and unclog clogged orifice.		1	44.00	44	one-ton truck	0.25	26.84	7			51
				Notify engineer, if immediate solution is not evident.		1	44.00	44				0			44
Inspection for trash and debris	Debris/trash present	Visual observation	During routine trashing, per Districts schedule.	Remove and dispose of trash and debris	None	0	44.00	0				0			0
Inspection for sediment management and characterization of sediment for removal -b	Sediment depth exceeds marker on staff gage	Measure depth at apparent maximum and minimum accumulation of sediment. Calculate average depth	Annually	Remove and properly dispose of sediment. Regrade if necessary.		4.8	44.00	211	4-yd dump truck, backhoe & trailer, one-ton truck & hydroseeder sedan	0.2	176.50	35	testing and disposal	325	572
Inspect for burrows	Burrows, holes, mounds	Visual observation	Annually and after vegetation trimming.	Where burrows cause seepage, erosion and leakage, backfill firmly.		2	44.00	88	one-ton truck	0.25	26.84	7			95
General Maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, emergence of trees or woody vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Semi-Annually, late wet season and late dry season	Corrective action prior to wet season. Consult engineers if immediate solution is not evident.	None	8	44.00	352	one-ton truck & hydroseeder	0.5	48.15	24	Seed and Blanket	160	536
Reporting						3	44.00	132							
TOTAL EXTENDED DETENTION BASIN						56		2464				133		535	3132

- a. assumes cost of equipment for inspections is divided between at least two sites (two inspected/maintained per day-trip)  
b. assumes cleanout once every 5 years, three man crew, 8 hours per worker.  
c. Cost accounted for under general maintenance  
d. Assumes 1/yr, 2 man crew (2 hours including travel)  
e. Assumes 2/yr, 2-man crew (8 hours including travel)

## Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor			Equipment				Materials		Total
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost
INFILTRATION BASINS -a															
Based on 2 ha drainage area.															
Vegetation of basin invert and side slopes -c	Vegetation height exceeds 12 inches, emergence of trees or woody vegetation.	Visual observation and random measurements through out the side slope and invert area	Once during wet season, once during dry season.	Cut vegetation to an average height of 6-inches. Remove any trees, or woody vegetation.	None	32	44.00	1408	one-ton truck	2.	26.84	54	string trimmer, rake, fork, bags, safety equipment	50	1512
Inspect for standing water.	Standing water for more than 72 hours -d	Visual observation	Annually, 72 hours after a target storm (0.75 in) event.	Drain facility, if possible.		4	44.00	176	one-ton truck	0.25	26.84	7			183
				Notify engineer to consider:		1	44.00	44				0			44
				Remove sediment, scarify invert, and regrade if necessary. -e		0	44.00	0				0			0
				If unable to achieve acceptable infiltration rate or implement alternative solution then move to decommission		0	44.00	0				0			0
				If standing water can not be removed then notify VCD.	None	1	44.00	44				0			44
Inspection for trash and debris at inlet structures	Debris/trash present	Visual observation	During routine trashing, per Districts schedule.	Remove and dispose of trash and debris	None	0	44.00	0				0			0
Inspection for sediment accumulation -b	Sediment depth exceeds marker on staff gage.	Measure depth at apparent maximum and minimum accumulation of sediment. Calculate average depth	Annually	Remove, characterize and properly dispose of sediment. Regrade and revegetate bare areas.	None	5	44.00	211	4-yd dump truck, loader & trailer, grader, sedan, one-ton truck & hydroseeder	0.2	176.50	35	seed, testing & disposal	325	572
Slope stability -f	Evidence of erosion.	Visual observation	October each year.	Reseed/revegetate barren spots by Nov. Scarify surface if needed.		0	44.00	0				0			0
				If after two applications (2 seasons) of reseeding/revegetating and growth is unsuccessful both times, an erosion blanket or equivalent protection will be installed over eroding areas. No erosion blanket will be installed in the basin invert.		0	44.00	0				0			0
				Contact environmental or landscape architect for appropriate seed mix.	None	0	44.00	0				0			0
Inspect for burrows	Burrows, holes, mounds.	Visual observation	Annually and after vegetation trimming.	Where burrows cause seepage, erosion and leakage, backfill firmly.	None	2	44.00	88	one-ton truck	0.25	26.84	7			95
General Maintenance Inspection Reporting	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, emergence of trees or woody vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Semi-Annually, late wet season and late dry season	Take corrective action prior to wet season. Consult engineer if immediate solution is not evident.	None	8	44.00	352	two-ton truck	0.5	50.00	25	blanket	60	437
TOTAL INFILTRATION BASIN						3	44.00	132							
						56		2464				127		435	3026

a. assumes cost of equipment for inspections is divided between at least two sites (two inspected/maintained per day-trip)

b. assumes cleanout once every 5 years, three man crew, 8 hours per worker.

c. Assumes 2/yr, 2-man crew (8 hours including travel)

d. Assumes 1/yr, 2 man crew (2 hours including travel)

e. Sediment removal included with inspection for sediment accumulation

f. Cost accounted for in general maintenance.

## Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor			Equipment				Materials		Total	
							Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost
INFILTRATION TRENCHES -a																
Based on 2 ha drainage area.																
Inspect for standing water	Standing surface water for more than 72 hours	Visual observation	Annually, 72 hours after a target storm (0.75 in) event	Drain facility		4	44.00	176	one-ton truck	0.25	26.84	7			183	
					Notify engineer to consider:	1	44.00	44			0		44			
				Undertake investigation for course of action to achieve acceptable infiltration rate. -c If unable to achieve acceptable infiltration then BMP operations cease.			44.00	0				0			0	
				If standing water can not be removed, notify VCD.	None	1	44.00	44				0			44	
Inspection for trash and debris at inlet and outlet structures	Trash/debris present	Visual observation	During routine trashing per Districts schedule.	Remove and dispose of trash and debris.	None	0	44.00	0				0		0	0	
		Visual inspection of the stone aggregate, no sediment should be visible at the top of the trench due to sediment buildup from filter fabric.		Remove top layer of trench, silt, filter fabric and stone, wash stone and reinstall fabric and stone into trench prior to wet season.	None	14.4	44.00	634	back hoe, 2 -10 yd dump truck, 20-ton trailer	0.6	318.00	191	replacement stone and filter fabric	1200	2024	
Inspect for sediment accumulation -b	Visible sediment		Annually.		None											
General Maintenance Inspection Reporting	Inlet structures, outlet structures, filter fabric or other features damaged, emergence of trees or woody vegetation, graffiti or vandalism, fence damage, etc.				None Remove any trees, or woody vegetation.	4	44.00	176	one-ton truck	2.	26.84	54			230	
		Visual observation	Semi-Annually, late wet season and late dry season	Take corrective action, prior to wet season. Consult engineer if immediate solution is not evident.		3	44.00	132				251		1200	2639	
TOTAL INFILTRATION TRENCHES						27		1188								

a. assumes cost of equipment for inspections is divided between at least two sites (two inspected/maintained per day-trip)

b. assumes once every 5 years, in 3 days by three man crew.

c. Complete rehabilitation cost is unknown.

## Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor			Equipment				Materials		Total
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost
MEDIA FILTERS – PERLITE/ZEOLITE -a															
Based on 2 ha drainage area.															
Design flow rate through canisters: 15 gpm per canister	Standing water in the filter vault, visible scum line in the vault that is higher than the overflow weir.	Remove top of canister check to see if media is discolored and packed with sediment.	During one storm per wet season	Replace canisters according to manufacturer recommendations.	None	4	44.00	176	one-ton truck	1.	26.84	27			203
Inspect for sediment accumulation in pre-treatment sedimentation chamber -b	Sediment occupies 10% of the filter chamber volume.	Measure with appropriate device	Annually in May.	Remove sediment prior to wet season. Characterize sediment and properly dispose	None	12	44.00	528	boom truck	0.5	74.94	37	testing & disposal costs	600	1165
Inspect for minor maintenance -e	Per manufacture's guidelines	None	Annually	Clean per manufacturer's guidelines. Prior to wet season.	None.	0	44.00	0				0			0
Manufacturer's recommended major maintenance -g	Per manufacture's guidelines	Per manufacture's guidelines	Annually	Consult with manufacturer regarding need for replacement of canisters. If manufacturer confirms need, replace canisters. Prior to wet season. When canisters are changed send canisters to manufacturer to determine remaining life of the media	None	8	44.00	352	one-ton truck	1.	26.84	27	major maintenance	2200	2579
Inspection for trash and debris at inlet and outlet structures and within vaults -c	Trash/debris present	Visual observation	During routine trashing, per Districts schedule. -f	Remove and dispose of trash and debris when on site conducting inspections.	None	3	44.00	132	one-ton truck	0.5	26.84	13			145
Inspect for standing water -d	Water accumulation in any structure or other location within the filter	Standing water in any structure or other location within the filter	Annually, at end of wet season.	? Gravity drain where possible.		4	44.00	176	one-ton truck	0.5	26.84	13			189
				? If standing water can not be removed or remains through wet season notify VCD.	None	1	44.00	44				0			44
General Maintenance Inspection Reporting	Inlet structures, outlet structures, vault, piping, or other features damaged and for graffiti or vandalism	Visual observation	Semi-Annually, late wet season and late dry season	Take corrective action prior to wet season. Consult engineer if immediate solution is not evident.	None	8	44.00	352	one-ton truck	0.5	26.84	13			365
						3	44.00	132							
TOTAL MEDIA FILTERS – PERLITE/ZEOLITE						43		1892				131		2800	4823

a. assumes cost of equipment for inspections is divided between at least two sites (two inspected/maintained per day-trip)

b. assumes cleanout once every 3 years, three man crew, 12 hours per worker.

c. assumes twice/yr, 2 man crew (0.75 hours/trip including travel)

d. Assumes 1/yr, 2 man crew (2 hours including travel)

e. Accounted for in sediment inspection

f. Trash removal from vault BMP is not accomplished by crews during routine trashing.

g. Replacement of cansisters assumed every 5 years at \$11,000

## Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor			Equipment				Materials		Total
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost
MEDIA FILTERS – SAND WO/PUMP -a															
Based on 2 ha drainage area.															
Drain time of 48 hours	Drain time exceeds 72 hours	Determine drain time by visual observation	Annually, after one target storm (0.75 in) event during wet season	Remove sediment, trash and debris.		4	44.00	176	one-ton truck	1.	26.84	27			203
				Check orifice		1	44.00	44				0			44
				Notify engineer to consider removing top 2 inches of media and dispose of sediment.-e Restore media depth to 18 inches when overall media depth drops to 12 inches. Complete prior to wet season. -g	Escondido MS Delaware SF – Remove and restore media depth to 12 inches.	13.3	44.00	585	boom truck	0.75	74.94	56	sand, drums, shovel, rake, drum grappier, confined space equipment characterization and disposal	888	1529
Inspect for sediment accumulation in sedimentation chamber -b	Sediment depth exceeds marker on staff gage.	Measure with appropriate device	Measure sediment depth annually.	Remove sediment prior to wet season. Characterize sediment and properly dispose.		4.8	44.00	211	boom truck	0.2	74.94	15			226
Inspection for trash / debris c	Trash and debris present	Visual observation	During routine trashing, per Districts schedule. -f	Remove and dispose of trash and debris during routine trashing.	None	8	44.00	352	one-ton truck	0.5	26.84	13			365
Inspect for burrows	Burrows, holes, mounds.	Visual observation	Annual inspections after vegetation trimming.	Where burrows cause seepage, erosion and leakage, backfill firmly.	None	0	44.00	0				0			0
Inspect for standing water -d	Water accumulation in any structure or other location within the filter	Standing water in any structure or other location within the filter	Annually, 72 hours after a target storm (0.75 in)	Gravity drain where possible.		0	44.00	0				0			0
				Notify engineer, if immediate solution is not evident.		0	44.00	0				0			0
				If standing water can not be removed or remains through wet season notify VCD.	None	1	44.00	44				0			44
General Maintenance Inspection Reporting	Inlet structures, outlet structures, filter fabric or other features damaged, emergence of vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Semi-Annually, late wet season and late dry season	Within 30 working days, take corrective action. Consult engineer if immediate solution is not evident.	None	8	44.00	352	one-ton truck	0.5	26.84	13			365
TOTAL MEDIA FILTER-SAND WO/PUMP						3	44.00	132							
						43		1892				125		888	2905

- a. assumes cost of equipment for inspections is divided between at least two sites (two inspected/maintained per day-trip)  
b. assumes cleanout once every 5 years, three man crew, 8 hours per worker. Inspected under General Maintenance  
c. assumes twice/yr, 2 man crew (2 hours/trip including travel).  
d. Accomplished under drain time inspection  
e. Average actual time per pilot study. Equip cost of \$2500 every three years.  
f. Trash removal from vault BMP is not accomplished by crews during routine trashing.  
g. Assume replenishment every nine years. (3 man crew, 4 hours every 9 years) plus 9 year sand cost of \$55

## Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor			Equipment				Materials		Total
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost
MULTI-CHAMBER TREATMENT TRAINS -a															
Based on 2 ha drainage area.															
Maximum filter drain time of 72 hrs for design and smaller storms -g	Drain time greater than 72 hours or sediment accumulation is greater than 0.1 inch over more than 50 percent of the fabric surface area.	Visual observation	After one target storm (0.75 in) event during wet season.	Remove and replace filter fabric blanket.		4	44.00	176	one-ton truck	0.25	26.84	7	Filter Fabric	137	320
				If problem persists, consult with engineer, the media may need to be replaced. Complete prior to wet season.	None	1	44.00	44				0			44
Inspection for trash/ debris at inlet and outlet structures and the MCTT -c	Trash and debris present	Visual observation	During routine trashing per District schedule -f	Remove and dispose of trash and debris During routine trashing.	None	8	44.00	352	one-ton truck	0.5	26.84	13			365
Inspection for sediment accumulation -b	Sediment accumulates 50% of the volume underneath the tube settlers. Maximum of 2-feet grit chamber	Measure with appropriate device	Remove tube settler, measure sediment depth annually	Remove sediment prior to wet season. Characterize sediment and properly dispose.	None	4.8	44.00	211	one-ton truck	0.2	26.84	5	testing and disposal	325	542
Inspect for standing water -d	Water accumulation in any structure or other location within the device	Standing water in any structure or other location within the device	Annually	Where gravity draining is possible, drain the standing water. Where gravity draining is not possible, pump water from the structure. All structures should be as dry as possible at the end of the Wet Season to prevent possible mosquito breeding.		10	44.00	440	one-ton truck	0.5	26.84	13			453
				If standing water can not be removed or remains through the wet season notify VCD.	None	1	44.00	44				0			44
Replace filter media every 3 years per designer's specification -e	Operation greater than 3 years	Not applicable	Every 3 years	Remove and replace filter media. Characterize and properly dispose.	None	6	44.00	264	4-yd truck boom truck backhoe	0.75	182.01	137	media, testing and disposal	3444	3845
Inspect sorbent pillows in main settling chamber	Darkened by oily material	Visual Observation	Annually, in May.	Annually, renew sorbent pillows, or immediately if pillows are darkened by oily material, characterize and properly dispose.	None	4	44.00	176	one-ton truck	1.	26.84	27	sorbent pillows	100	303
General Maintenance Inspection Reporting	Inlet structures, outlet structures, filter fabric, settling tubes or other features damaged, emergence of vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Semi-Annually, late wet season and late dry season	Within 30 working days, take corrective action. Consult engineer if immediate solution is not evident.	None	8	44.00	352	one-ton truck	0.5	26.84	13			365
TOTAL MULTI-CHAMBER TREATMENT TRAINS						3	44.00	132							
						50		2200				216		4006	6422

- a. assumes cost of equipment for inspections is divided between at least two sites (two inspected/maintained per day-trip)  
b. assumes cleanout once every 5 years, three man crew, 8 hours per worker. Performed after draining at end of wet season.  
c. assumes twice/yr, 2 man crew (2 hours/trip including travel) Vaults not maintained by crews performing routine trashing.  
d. Assumes 1/yr, 2 man crew (5 hours including travel)  
e. Based on loading observed in pilot study, complete removal and replacement of media is expected every 9 years. Based on actual pilot study media cost, expected cost for 5 acre catchment is \$8,500. Disposal cost of \$22500  
f. Trash removal from vault BMP is not accomplished by crews during routine trashing.  
g. Assumes 3 yrs, 3 man crew, 4 hours and fabric for 82 m<sup>2</sup> at \$5/m<sup>2</sup>

<b>OIL-WATER SEPARATOR -a</b>															
Based on 2 ha drainage area.															
Inspect for sediment accumulation in the pre-separator and separator chamber -b	Greater than 12-inches	Measure with appropriate device	Annually	Prior to wet season, remove the accumulated material. Characterize and properly dispose.	None	3.2	44.00	141				0	testing and disposal	120	261
Inspect for oil accumulation in oil chamber -c	Oil depth is not more than 50 percent of chamber volume	Gauge the level of oil/water with a wooden gauge stick	Annually	Prior to wet season remove and properly dispose of oil and grease.	None	1.6	44.00	70				0	testing and disposal	60	130
Inspect coalescer for debris and gummy deposits present	Debris or gummy deposits present	Visual observation	Annually	Wash the coalescer in an appropriate area with high-pressure hot water when needed.	None	1	44.00	44				0			44
Inspect water level in tank	Less than full	Visual observation	Annually	Fill with water prior to wet season.	None	1	44.00	44				0			44
Inspect for general mechanical integrity	Per manufacture's guidelines	Per manufacture's guidelines	Annually	Operate each mechanical component to ensure proper operation. Repair as needed	None	4	44.00	176				0			176
Reporting						3	44.00	132							
<b>TOTAL OIL-WATER SEPARATOR</b>						14		616				0		180	796

- a. Maintenance hours includes inspection time, which will occur whether or not maintenance will be required.  
b. assumes maintenance needed every 5 years, 2 people-one day  
c. assumes maintenance needed every 5 years, 2 people-half day

## Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor			Equipment				Materials		Total
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost
<b>WET BASIN</b>															
Based on 2 ha drainage area.															
24-hour draw down measured between the rim of the outlet structure and invert of the WQ orifice in the outlet structure. -c	Drawdown greater than 25 hours or water is flowing over weir.	Evaluate drain time from inlet and outlet flow data loggers or observe 25 hours after target storm (0.75 in) Observation of water flowing over spillway	Once during wet season and after completion or modification of the facility.	If >25-hours: Open gate to discharge water to permanent pool elevation. Clear outlet of debris. Consult engineer if needed. If water is spilling over weir, open canal gate until water level is at permanent pool elevation. Check/clear outlet of debris.	None	2	44.00	88	one-ton truck	1.	26.84	27			115
						0	44.00	0			0		0		
						1	44.00	44			0		44		
						0	44.00	0			0		0		
						0	44.00	0			0		0		
Inspect for burrows	Burrows, holes, mounds	Visual observation	Annually and after vegetation trimming.	Where burrows cause seepage, erosion and leakage, backfill firmly.	None	4	44.00	176	one-ton truck	1.	26.84	27			203
General Maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, graffiti or vandalism, fence damage, etc.	Visual observation	Semi-Annually, late wet season and late dry season	Take corrective action, or restore to as-constructed condition prior to wet season. Consult engineers if immediate solution is not evident.	None	4	44.00	176	one-ton truck	1.	26.84	27			203
	Observable vegetation coverage/density	Visual, visible vegetation growth or emergent vegetation growth	Quarterly	Inspect		8	44.00	352							352
Inspect Zone 1 for vegetation coverage and density to sustain vector abatement efficacy (See attachments for zone locations.)				1. Have a biologist survey the Wet Basin to determine if any birds are nesting or other sensitive animals are present. If birds are nesting, with advice from the biologist, proceed with the maintenance. -e		4	70.00	280	sedan	1.	21.28	21			301
				2. Lower and maintain the water level to expose the area to be maintained, do not completely drain basin		2	44.00	88	one-ton truck	1.	26.84	27			115
				3. Cut plants/vegetation -d		240	44.00	10560	one-ton truck	3.	26.84	81	string trimmer, hand tools, bags, safety equipment	100	10741
				4. Dispose of the vegetation material in a landfill or other appropriate disposal area. -f		0	44.00	0	packer	3.	53.44	160	Disposal cost	4100	4260
				5. Restock mosquito fish as recommended by vector control agency.	None	0	70.00	0				0			0

### Expected O & M Costs for Idealized BMP Retrofits

ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENT	Labor			Equipment			Materials		Total
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost
Inspect Zone 2 for vegetation coverage and density to sustain vector abatement efficacy -a	Vegetation density is such that mosquito fish cannot swim freely in the planted area.	Mosquito fish cannot be seen in the planted area, vegetation density approximately 80 to 100 percent	Quarterly	Annually, or at a special request of the local vector control agency		0	44.00	0				0		0
				1. Have a biologist survey the Wet Basin to determine if any birds are nesting or other sensitive animals are present. If birds are nesting, with advice from the biologist, proceed with the maintenance.		0	70.00	0				0		0
				2. Lower and maintain the water level to expose the area to be maintained, do not completely drain basin		0	44.00	0				0		0
				3. Cut and Remove Typha sp. (cattail), Scirpus sp. (bulrush) to produce random vegetation clusters (2-5 plants) with clusters at approximately 0.5 meters on center. An effort should be made to maintain a ratio of Scirpus to Typha of 2:1. If the vegetation is cut, cut the vegetation to below the permanent pool water surface.		0	44.00	0				0		0
				4. Dispose of the vegetation material in a landfill or other appropriate disposal area.		0	44.00	0				0		0
				5. Monitor vegetation density quarterly to determine grow back rate. -g	None	0	44.00	0				0		0
Maintain Vegetated Access Road to reduce fire hazard from contact with vehicle catalytic converters. (See attachments.)	Average vegetation height exceeds 6 inches.	Visual inspection of vegetation throughout maintenance access road. Sediment depth exceeds marker on staff gage. Measure in forebay by estimating depth using stationing along concrete maintenance ramp. In main pond by measuring down from water quality orifice and comparing to as-constructed grade.	Annually prior to dry season	Mow before dry season. -h	None	0	44.00	0				0		0
Inspect for sediment accumulation in forebay and main pond -b	More than 2 inches in the forebay and 4 inches in the main pond, or			Remove and properly dispose of sediment. By November, restore vegetation to the plan shown on the as-built drawings.	La Costa site only	4.8	44.00	211	one-ton	0.2	26.84	5	300	517
Reporting						3	44.00	132						
<b>TOTAL WET BASIN</b>						273		12012				375	4500	16887

**TOTAL WET BASIN**

- a. Cost included in Zone 1  
b. assumes cleanout once every 5 years, three man crew, 8 hours per worker.  
c. Assumes 1/yr, 2 man crew (1 hours including travel)  
d. Actual time spent for the 2001 harvest.  
e. Survey only expected once per year prior to major maintenance.  
f. Cost are included in the hours for cut plants/vegetation.  
g. Included in quarterly inspection of zone 1 and 2.  
h. Vegetated access roads are not recommended in future designs